

# Ultra-low Power Multi-Point Remote Sensing Technology Using Optical Fiber Power Supply for Sewage Systems

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**Abstract**— Recent change of climate and growth of environmental awareness encourages the need for close control of sewage systems in metropolitan area, and its sensing and visualization becomes ever important to reduce the risk of its flooding, pollution, odor issues and so on. However, remote sensing of actual underground sewage systems faces many difficulties such as the lack of reliable communication and power feeding media, the risk of submergence, the generation of corrosive and explosive gasses, and so on. To overcome it, we have developed an ultra low-power multi-point sensing system utilizing a single strand of optical fiber as power supply and communication media. It enables reliable and fast real-time monitoring and surveillance of various quantities in under-ground sewage systems utilizing diverse sensors and cameras, such as water-height, water quality, gas concentration, surface status of sewage water and its overflow. One of the key challenges of its realization is significant reduction of power consumption, since available power from the optical power supply is tightly limited to less than several milli-watts due to fiber loss, branch loss and power conversion efficiency. This paper will report its concept, circuit design for optical power supply and multi-point bidirectional communication, implementation of low-power sensors and camera, and their performances.

**Keywords**— *Environmental sensing, Low-power sensing, Sewerage systems, Sensors, Optical fiber, Camera*